PFRP

Pelagic Fisheries Research Program

Volume 7, Number 3

July–September 2002

Predicting Post-Release Survival in Pelagics

LIBRARY
NOAA, NMFS Honolulu Lab.
2570 Dole St.
Honolulu, Hawaii 96822-2396

Nuno Fragoso and Chris Moyes

Catch-and-release sports fishing and non-retention of commercially caught fish are justifiable management options only if there is a reasonable likelihood that released fish will survive the trauma of catch-and-release. Because of this, successful management strategies in sports fisheries and commercial fisheries require information about the prospects for survival of released fish. All recreational anglers and commercial fisherman who practice catch-and-release fishing hope that the released fish will survive. But while it is safe to say that 100% of retained fish will die, it is not known what proportion of released fish will survive. Tag-and-release studies, which have been used broadly within fisheries management, frequently find significant post-release mortality, often days or weeks after release. These studies are vital to assessing post-release survival, but they can be difficult and expensive to implement. In addition, conclusions from tag-and-release studies are often difficult to extrapolate to other species; factors such as fish size, water temperature, fight time and fishing gear can influence survival.

Using funds provided by the Pelagic Fisheries Research Program (PFRP), we have been working closely with personnel from the National Marine Fisheries Service (NMFS) to develop tools that we hope will reduce the need for tagging studies. Whereas tagging studies assess how many fish survive, we are trying to understand why fish die. We are developing a set of diagnostic tools to assess the biochemical and physiological condition of fish captured on various gear. Our application of these tools is closely coordinated with tagging studies by Rich Brill (NMFS, Kewalo Research Facility) and Mike Musyl (PFRP and Joint Institute for Marine and Atmospheric Research).

We focused first on the post-release survival of blue sharks, which are frequent by-catch of Pacific longliners. Using the NMFS vessel *Townsend Cromwell*, we captured blue sharks on scientific longline gear. Blood samples were collected from approximately 20 sharks that were fitted with pop-off satellite archival tags (PSATs). Analysis of the blood samples allowed us to evaluate the physiological condition of the sharks when they were released, and the information from the PSATs establishes how long the sharks survived. Our goal is to develop predictors of survival based upon analysis of a single blood sample taken just prior to release. Although we focused first on blue sharks, we are anxious to apply this approach broadly to other commercial and recreational fisheries.

Queen's University researcher Nuno Fragoso (center) collects blood from a blue shark while NMFS scientist Richard Brill (right) attaches a PSAT to the dorsal fin.

Analysis of Blood Samples

When a fish is caught, it experiences many different physiological challenges that can affect its long-term survival. Our analysis is similar to that used by doctors examining a patient in an emergency room. Every few seconds each red blood cell passes through the heart, travels along blood vessels that permeate the tissues, and returns to the heart. When blood passes through the body, it is changed in many ways that are illustrative of the state of the tissues—and a great deal of information about an animal's health can be obtained from a blood sample.

Hooked fish may lose significant amounts of blood. If too much blood is lost, a fish may no longer be able to provide sufficient oxygen to its tissues. Blood loss is assessed by measuring

(continued on page 2)

CONTENTS

Predicting Post-Release Survival in Pelagics 1
Recreational Meta-Data: Using Tournament Data to Describe a Poorly Documented Pelagic Fishery 3
Upcoming Events 5
Longlining in American Samoa—the Fleet and its Economics 6
Prep Con II—Progress on MHLC Financing and Scientific Structure 9

hematocrit, which reflects the level of blood cells in circulation. When fish are captured on fishing gear, the vigorous swimming activity can deplete energy stores. When any animal undergoes extreme exercise, muscles produce high levels of lactic acid, which is released into the circulatory system; blood lactic-acid levels therefore reflect the amount of exercise an animal has experienced. Maintaining an ability to swim after exhaustive exercise is important to evade predators, and critical for large pelagic species that must continue swimming to breathe. If fish have used too much metabolic fuel deposits, they may be unable to recover from an exercise bout (Moyes and West, 1995).

Strenuous exercise also results in muscle damage. Other forms of tissue damage could conceivably arise as a result of capture; these include heart attacks, kidney failure, liver damage and brain damage. Damaged tissues release their intracellular contents into the circulatory system, and because many cells possess unique cellular markers, the presence of these molecules in the blood can be used as an index of tissue damage. By characterizing the profile of blood proteins, we are able to assess the degree of tissue damage. For example, when humans suffer heart attacks, their heart cells release the proteins creatine kinase and troponin I into the plasma. On the other hand, acute liver cell damage results in the release of the proteins alanine aminotransferase and aspartate aminotransferase. For this reason, comprehensive analysis of plasma constituents can provide many insights into animal health.

We are also using the properties of blood cells themselves to assess the extent of tissue damage. When fish blood experiences hazardous conditions such as high temperature or oxidative stress, it can activate a line of defense that minimizes the damage to the blood cell. This "stress response" is recognized by stimulation of genes that lead to production of a suite of protective proteins called heat shock proteins, or hsp. Our analysis of hsp synthesis can be used to categorize the extent of the stress experienced by the blood cells (Currie, Tufts and Moyes, 1999).

As of May 2002, we have completed analysis of the first year of our study. A second set of sharks was sampled and tagged in April.

Outcome of Tagging Studies

In recent years, sharks have comprised about 45% of the catch on longline research cruises aboard the *Townsend Cromwell*. The dominant shark species caught has been blue sharks, and in the past 2 years we have collected blood samples from 46 blues, 31 of which were fitted with PSATs by Brill and Musyl. These tags will provide environmental and behavioral details about these animals (PFRP Newsletter Volume 6, #3). They will also provide a record of survival upon release. Blood samples also were collected from 4 blue sharks that were morbid upon capture or released without tags.

The PSAT data from the blue sharks tagged in 2001 has shown that the sharks are remarkably resilient. Although none of the 16 sharks we sampled died within a week of release, many displayed clear signs of stress:

- six had elevated creatine kinase levels and lactate dehydrogenase levels, which are indicative of muscle damage;
- five had very high levels of lactic acid, which is indicative of exhaustive exercise;
- one shark that was dead when captured showed signs of a fatal heart attack, its blood laced with high levels of the heart protein troponin I; and,
- all of the sharks showed some signs of oxidative stress as demonstrated by heat shock protein mRNA blotting.

Following analysis of the blood samples collected in April from 24 blue sharks, we will expand our analysis of stress indicators to help understand the factors that cause delayed mortality of sharks and other large pelagics upon release. We believe these studies can be a valuable tool for fisheries managers, and are anxious to apply the technology to other fisheries.

References

Moyes, C.D., and T.G. West. 1995. Exercise metabolism of fish. In Biochemistry and Molecular Biology of Fishes. P.W. Hochachka & T.P. Mommsen (eds.), Elsevier Press, pp. 367-392.

Currie, S., B.Tufts and C.D. Moyes. 1999. Influence of bioenergetic stress on heat shock protein gene expression in nucleated red blood cells of fish. American Journal of Physiology. 276: R990-R996.

PFRP

Chris Moyes is an Associate Professor at Queen's University in Kingston, Canada. A comparative physiologist, he studies the ways in which cells respond to stressful conditions, focusing on the role of energy metabolism. For more information on his research, visit http://biology.queensu.ca/~moyesc/.

Recreational Meta-Data: Using Tournament Data to Describe a Poorly Documented Pelagic Fishery

Daniel S. Curran, Paul Dalzell and Joseph O'Malley

The Recreational Meta-Data Project was initiated to identify and compile into databases the diverse sources of information on Hawai'i's pelagic recreational and sports fishing over the past 50 years. No comprehensive, official record of Hawai'i's recreational fishery exists, but there are many sources of information in the form of surveys, previous studies, club records, newspaper articles, and fishermen's logbooks. Some fisheries researchers have found such irregular data sources to be valuable when examined in aggregate or over a long period of time. Our project is amassing a database that attests to the large scope of Hawai'i's poorly documented pelagic recreational fishery.

Background

Hawai'i's recreational anglers have always enjoyed the freedom to fish without the burden of licensing and data collection from government agencies. Efforts to license recreational anglers did occur after the legislature repealed a defunct salt-water licensing program in 1949 (Ball, 1975), but the efforts failed due to strong public sentiment against having to pay even a nominal fee for access to ocean resources that traditionally have been free to all. This has resulted in a lack of historical documentation about the number of anglers and their catch, which has made it difficult for agencies to consider recreational fishing concerns when making policy decisions about allocation of marine resources.

Recreational fishing does play a significant role in the lives and economics of Hawai'i's populace. A survey in 1996 estimated that 260,005 anglers spent more than $130 million in direct expenditures to participate in recreational fishing in Hawai'i (Maharaj and Carpenter, 1996). Periodically, other surveys have documented the importance of pelagic recreational fishing in Hawai'i, but there exists no continuous, comprehensive record of recreational fishing, and most surveys point out the need for such a record (Hamilton, 1998; Kahiapo and Smith, 1994). Our project is an effort to provide enough historical documentation to enable examination of recreational data over a span of several years, thus ensuring that recreational concerns are addressed in future management decisions.

Research Methods

First, we scanned all the reports and previous surveys we could obtain, converted them into electronic files, and inputted accompanying tables into spreadsheets. Next, we began contacting different anglers, fishing clubs, and tournament directors throughout Hawai'i, and were pleased with the positive response. To date, we have received information on 27 different tournaments from 6 different clubs, and we expect to receive information on about 6 more tournaments. We have annual information covering more than 20 years of catch and effort, and some tournaments are well documented.

Once obtained, tournament information is copied and returned to the provider along with a spreadsheet and summary charts. Information in the form of "radio call-in logs" or official weigh-in slips is then keypunched into our database for analysis. When a boat hooks and lands a fish during a tournament, it is required to radio in an official report of the place, species and estimated weight of the catch. This running log, coupled with an official tournament weigh-in slip completed at the end of the fishing day, is then integrated into our database.

Results and Discussion

Tournament information has been the largest source of data collected, providing valuable insights into the nature and scope of Hawai'i's pelagic recreational fishery. Unfortunately, there is no standard methodology for reporting tournament catches, so the information we received varies from tournament to tournament.

Information on effort, catch and tournament totals illustrates the unique nature of tournament reporting habits (Figure 3). Most tournaments do not differentiate between bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*T. albacares*); these species are listed simply as "ahi." Reports listing marlin can also refer to one or more of several *Istiophoridae* species, while skipjack tuna (*Katsuwonus pelamis*) is only recorded for some of the tournaments. Despite these vagaries of species identification, tournament records do provide insight into hook-up rates, catch composition, and average catch weight (Figure 1).

Data from a single tournament plotted across a time series are useful in determining cyclical peaks in catch abundance of different species (Figure 2). Catching a thousand-pound marlin is the goal of tournament participants, but the catch of mahimahi (*Coryphaena hippurus*) and ahi dominates the numerical catch totals. Although catch per unit effort (CPUE) indices do show cyclical trends in catch abundance within a single tournament and species group, CPUE trends that were compared across tournaments for a single species group do not appear to be correlated (Figure 3).

Originally, we thought we would be able to construct weight-frequency charts from the radio logs in order to discern trends in size-at-catch within the tournament fishery. Unfortunately, the practice of rounding estimated weights compounded by the lack of accurate species identification has so muddied the picture that weight-frequency charts probably will not provide much information to fisheries researchers (Figure 4).

Data from all tournaments combined show that participants rely heavily on fish aggregation devices (FADs) placed by the State of Hawai'i. Off the leeward coast of O'ahu, more than 86% of the

(continued on page 4)

Recreational Meta-Data (continued from page 3)

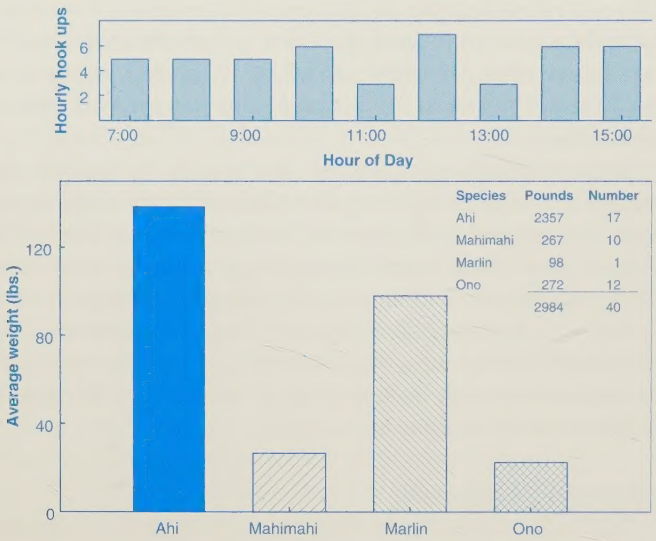


Figure 1. Summary results from a 28-boat tournament held in July 2000 on Kaua'i, showing total catch and average weight in pounds for each species group (Ahi= Thunnus obesus and T. albacares, Mahimahi= Coryphaena hippurus, Marlin= Istiophoridae, Ono= Acanthocybium solandri).

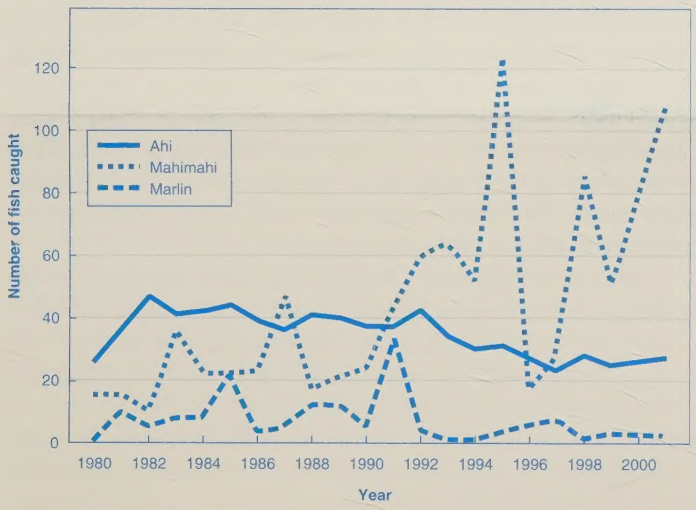


Figure 2. Annual tournament held off of leeward coast of O'ahu 1980–2001 showing numerical predominance of ahi (Thunnus obesus and T. albacares) and mahimahi (Coryphaena hippurus) over marlins (Istiophoridae) in tournament catch.

catch from all tournaments comes from the five geographic locations that contain FADs. Similarly, catch plots from tournaments off the island of Hawai'i show that almost all of the catch for these tournaments comes from areas that contain FADs (Figure 5).

Conclusion

Developing a clear understanding of the scope and nature of Hawai'i's pelagic recreational fishery is vital to efforts to draw an

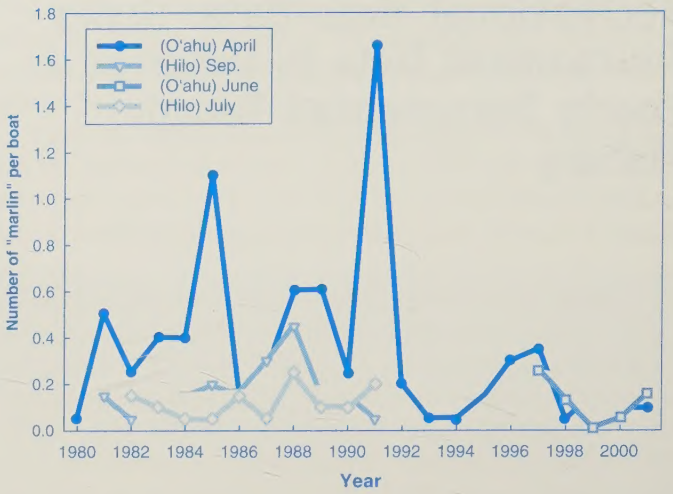


Figure 3. Catch per unit effort indices as number of marlin (Istiophoridae) per boat per day from 4 tournaments held off of the islands of O'ahu and Hawai'i.

accurate picture of this poorly documented fishery. This project has filled many gaps in our knowledge while illustrating the need to continue collecting information from poorly documented recreational activities. Without such an effort, it will be difficult for recreational interests to be reasonably considered when agencies weigh management issues. We feel that the information gathered so far by this project can serve as a springboard to facilitate continued data collection at fishing tournaments in Hawai'i.

Acknowledgments

We would like to thank Kanoe Renaud and all club members who willingly provided tournament information, and the following clubs in particular: Hawai'i Yacht Club, Waikiki Yacht Club, Port Allen Fishing Club, Westside Boat Club, Hilo Trollers, Wai'anae Boat Fishing Club, and the Hawai'i International Billfish Association.

References

Ball, J. (1975). Fisheries and the state of Hawai'i input to the national fisheries plan. Working Paper No. 4, Sea Grant College program. University of Hawai'i. 80 pp.

Hamilton, M. (1998). Cost-earnings study of Hawai'i's charter fishing industry 1996-1997. Pelagic Fisheries Research Program, University of Hawai'i Joint Institute for Marine and Atmospheric Research, 1000 Pope Rd., Honolulu, Hawai'i 96822. 109 pp.

Kahiapo, J. and Smith, K. (1994). Shoreline creel survey of Hilo Bay Hawai'i: 1985-1990. A report on research for the Main Hawaiian Islands Marine Resources Investigation (MHI-MRI). Division of Aquatic Resources, Department of Land and Natural

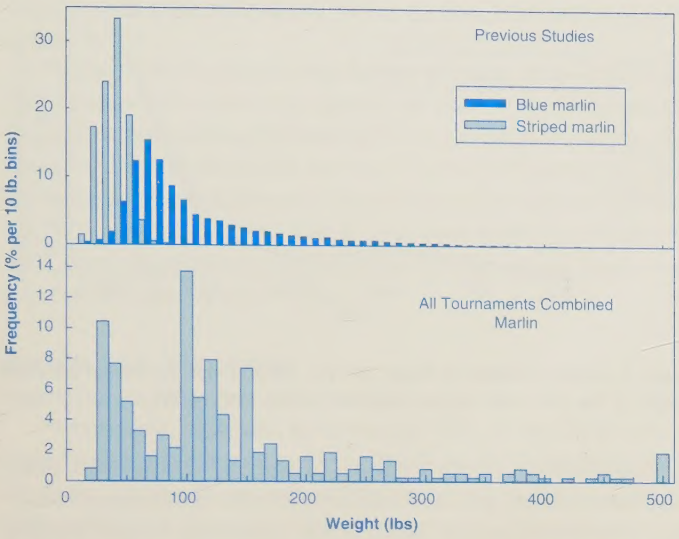


Figure 4. Size class frequencies for marlin catch from previous data on blue marlin (*Makaira mazara*) and striped marlin (*Tetrapturus audax*) in the Central Pacific, compared with size class frequencies from 27 Hawai'i tournaments from 1959–2001.

Resources, 1151 Punchbowl St. Room 330, Honolulu, Hawai'i 96813. 31 pp.

Maharaj, V. and Carpenter, J. (1996). The 1996 economic impact of sport fishing in Hawai'i. American Sportfishing Association, 1033 North Fairfax St. Suite 200, Alexandria, Virginia 22314. 10 pp.

PFRP

Daniel Curran (daniel.curran@noaa.gov) is a fisheries biologist and Joseph O'Malley a fishery survey research specialist in the Honolulu office of the National Marine Fisheries Service. Paul Dalzell is a fisheries biologist with the Western Pacific Regional Fishery Management Council in Honolulu.

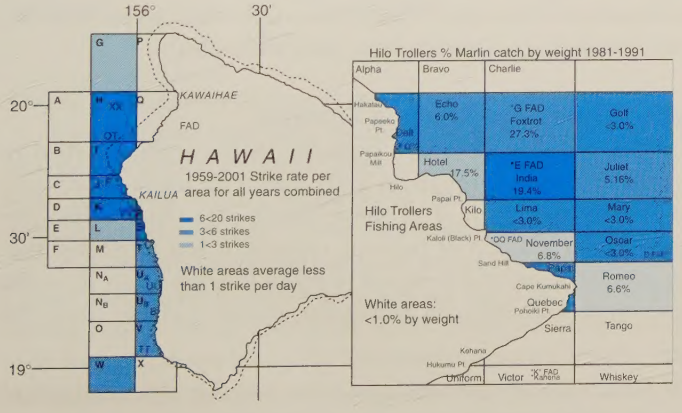


Figure 5. Tournament catch locations from the island of Hawai'i illustrating the importance of the location of FADs, and the predominance of catch coming from areas that contain FADs.

Upcoming Events

The Fifteenth Meeting of the Standing Committee on Tuna and Billfish (SCTB)

The Fifteenth Meeting of the SCTB will be held in the Hawai'i Convention Center in Honolulu July 22–27, 2002. It is expected to attract special attention because the nascent Western and Central Pacific Fisheries Commission (of the MHLC) will be indirectly seeking SCTB advice on the status of major tuna stocks in the region. Further details and a provisional agenda for SCTB 15 can be found on the PFRP website (http://imina.soest.hawaii.edu/PFRP/).

Meeting of the Scientific Coordinating Group

In addition, representatives at the MHLC Prep Con 2, held late in February in Papua New Guinea, agreed to establish a Scientific Coordinating Group (SCG) to receive information on the status of skipjack, yellowfin, bigeye and southern albacore tuna, and provide interim management advice to the Prep Con. The first meeting of the SCG will follow SCTB15 on July 29–31 at the East-West Center in Honolulu. Visit the PFRP web site for more information.

Pelagic Fisheries Research Program Newsletter
Volume 7, Number 3 **July–September 2002**

Editors Chris Anderson, John Sibert
Writers Daniel Curran, Paul Dalzell, Nuno Fragoso, Chris Moyes, Joseph O'Malley, John Sibert, Samuel Pooley, and Chris Anderson
Layout May Izumi
Printing Quality Graphics & Printing, Inc., Honolulu, Hawaii 96814

For more information
Pelagic Fisheries Research Program
Joint Institute for Marine and Atmospheric Research
University of Hawai'i at Mānoa
1000 Pope Road, MSB 313
Honolulu, HI 96822
TEL (808) 956-4109 FAX (808) 956-4104
E-MAIL jsibert@soest.hawaii.edu
WWW http://www.soest.hawaii.edu/PFRP

Longlining in American Samoa—the Fleet and its Economics

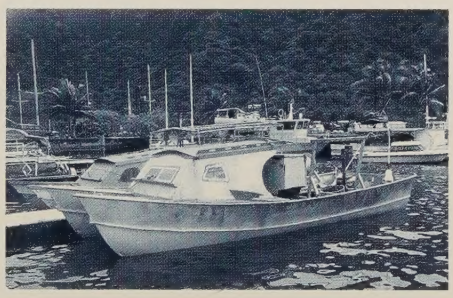
Joseph M. O'Malley & Samuel G. Pooley

The American Samoa longline fleet expanded markedly in 2001. Prior to that, the fleet was comprised primarily of local catamaran alias (Figure 1a) targeting South Pacific albacore (Thunnus alalunga) *for the two canneries in American Samoa. The alias also caught bigeye tuna* (Thunnus obesus), *yellowfin tuna* (Thunnus albacares), *skipjack* (Katsuwonus pelamis), *dolphin* (Coryphaena hippurus), *and wahoo* (Acanthocybium solandri) *for the canneries, local markets and subsistence. Generally <30' in length, the alias take 1- to 3-day trips and have no or very limited modern technology.*

During 2001, 25 modern longline vessels, known locally and therefore referred to herein as "big boats," entered the fishery; there were only 3 active big boats in 2000 (Figure 1b). These vessels are >50' in length, and possess modern communications and other fish-finding technology. The big boats also have freezers (blast or brine), whereas the alias have limited fish storage and carry little ice. The sudden entrance of big boats into the fleet is reflected in an abrupt increase in the number of hooks set/year, as well as an increase in albacore catches (Figure 2).

Evolution of a Longline Fleet

The entrance of big boats into American Samoa's longline fleet has drawn considerable attention from fisheries managers, and a number of issues have arisen due to the increase in fleet size and capability. The Western Pacific Regional Fishery Management Council (WPRFMC) has classified these issues into three areas–avoiding gear conflicts, maintaining the potential for economically viable catch rates in the small-scale fishery, and maintaining cultural identity and dependence on ocean resources (WPRFMC 2000). A nearshore area closure has been implemented, and a limited entry system is being considered. It is hoped that these two management devices will prevent the issues from developing into problems.



Figures 1a and 1b. Typical American Samoa alia (top) and 'big boat' (below).

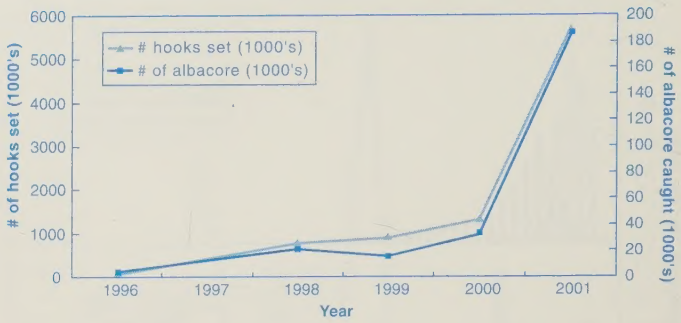


Figure 2. Annual number of hooks set (in 1000's) and number of albacore caught in the American Samoa longline fishery, 1996–2001.

The objectives of this study are to describe the big boats' physical characteristics, provide baseline economic information associated with operating the boats in the American Samoa longline fleet, and document fishers' opinions on specific management devices and other fisheries-related issues. This information is required by the Magnuson-Stevens Fishery Conservation and Management Act[1] to allow fisheries managers to consider the potential economic effects of future regulations.

Data Collection

Vessel owners, managers, or operators were personally interviewed at Pago Pago Harbor from December 5 through December 21, 2001; any vessel in port during this period was approached. Survey questions focused on variable costs (those incurred when a vessel actively fishes) and fixed costs (those incurred regardless of the number of trips a vessel takes) as well as vessel characteristics, demographics, and fishers' comments and preferences about future management alternatives.

Commercial fishing industry members were also interviewed, and they provided pertinent auxiliary information on the longline fleet. Commercial logbook information, including catch and effort, as well as vessel characteristics and activity, was provided by the National Marine Fisheries Service, Western Pacific Fisheries Information Network (WPacFIN— web site: http://wpacfin.nmfs.hawaii.edu/as/Data/Pages/as_data_main.htm).

Expenditures and Revenue Analysis

Only 5 of the 18 vessels included in the analysis fished in American Samoa throughout 2001. Based on logbook and vessel activity data from 3 of these vessels (the other 2 had not completed a full year of logbook reports) it was estimated that the average vessel could expect to make 17 trips a year if 14 sets were made each trip. To determine annual variable costs, the

[1]SEC. 303 Contents of Fishery Management Plans 16 U.S.C. 1853 95-354, 99-659, 101-627, 104-297. (a) Required Provisions. – Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery shall—(2) contain a description of the fishery, including,...the cost likely to be incurred in management, actual and potential revenues from the fishery...

variable cost information per trip (e.g., fuel, bait, ice) was multiplied by 17.

Because this is a developing fishery, a "break-even" estimation (the amount of landed fish needed to match expenses) is one method of determining the level of fishing effort necessary to sustain a big boat in American Samoa. This was estimated by calculating the amount of albacore (the primary target species) at average 2001 prices that would have to have been landed to match total 2001 costs. An analysis was conducted examining the break-even point at different albacore prices.

Results and Discussion

Interviews and Big-Boat Description

Twenty-two big boats, representing 79% of the fleet, were in Pago Pago Harbor between December 5 and December 21, 2001. Of those, 18 vessels, or 64% of the fleet, were willing to provide information via interviews; this represented an 82% response rate for the survey.

Vessels described herein as big boats are large modern longliners. Except for 2 vessels using icemakers, these vessels in American Samoa had or were in the process of installing either blast or brine freezers. They also used large hydraulic reels and monofilament mainline, and were equipped with radar, GPS, VHF, SSB, temperature sensors, autopilot and lineshooters. Specific physical and operating characteristics of the vessels are summarized in Table 1.

Table 1. Physical and operational characteristics of big boats in the American Samoa longline fleet.

Characteristic	Average	Standard Deviation	n
Vessel overall length (feet)	69.2	12.8	18
Vessel age (years)	16.3	9.4	18
Main engine size (horsepower)	457.0	199.6	15
Fuel capacity (gallons)	13,056.0	6,320.0	18
Fuel/day travel (gallons)	216.0	91.0	16
Cruising speed (knots)	8.4	1.3	18
Mainline length (miles)	42.0	11.0	17
Hooks/set	2,141.0	529.0	17

Annual Costs and Break-Even Points

Reported total costs were estimated at $28,228 per trip, and total annual costs at $479,857 (Table 2). Labor was the highest cost to the American Samoa longline owner; insurance was the highest individual fixed cost, and fuel was the highest variable cost.

Based on the average 2001 albacore price of $2,496/t ($1.13/lb) a vessel would have to have landed 424,651 lbs of albacore to meet average annual fishing costs of $479,857. Given an average weight of 45 lbs for albacore landed by the American Samoa longline fleet (WPacFIN), this means a vessel would have to have landed 9,437 albacore annually, or 555 albacore per trip (based on 17 trips per year), or 40 albacore per set (based on 14 sets/trip), or 0.019 albacore per hook (based on 2,141 hooks/set).

Table 2. The 2001 averages and standard deviations of the estimated annual revenue and fixed and variable costs of the American Samoa big boat longline fleet.

Income Statement	Average (US$)	Standard Deviation (US$)	n
Fixed Costs Total	**101,039**		
Capital costs	35,578	11,856	16
Insurance	26,533	10,515	15
Bookkeeping	1,609	1,443	11
Mooring	6,480	0	0
Overhaul	1,558	900	13
Dry dock	4,077	2,682	13
Daily maintenance	13,691	21,200	16
Other repairs in 2001	3,333	577	3
Misc. costs	8,180	3,643	10
Variable Costs Total*	**200,923**		
Fuel	73,314	44,969	16
Oil	5,085	3,588	14
Ice (for non-albacore catch)	10,090	4,165	10
Bait	60,318	21,582	16
Resupply fishing gear	29,378	21,706	16
Provisions	22,738	7995	16
Labor Costs Total	**177,895**		
Captain's share	68,421		
Crew share+	109,474		
Total Costs	**479,857**		

*Presented as estimated yearly costs if 17 trips were made

+Crew share consists of 5 crew members earning a 6, 5, 5, 4 and 3 shares.

Logbook information from 10 vessels indicates that an average of 13,036 albacore was caught in 2001; therefore, the fleet last year was likely operating above expenses. In addition, further analysis indicates that at the current (March 2002) price of $1,884/t, the fleet is barely meeting expenses and possibly only generating income through landings of incidental species. If the price continues to drop to $1,500/t the fleet will clearly be operating at a net loss (Table 3).

Fishers' Responses

In addition to economic queries, the owners and operators were asked open-ended questions about their vessels' plans and future management of the American Samoa longline fishery. Ten fishers responded to these questions.

Nearshore area closure: At the time of the interviews, WPRFMC was considering implementation of a nearshore area closure that would restrict longline vessels >50' in length from fishing within 50 nm of shore. Fishers were asked "Do you feel that the proposed nearshore area closure (waters <50 nm from shore are closed to vessels >50' in length) will positively or negatively affect your operations? Why?" Ten percent of those interviewed felt

(continued on page 8)

Table 3. Breakeven estimation at various cannery prices for albacore and the 2001 vessel landing averages. Needed amount and poundage are based on vessel costs of $479,857 annually.

Albacore Catch Needed to Meet Expenses	Albacore Price/Ton 2001 Avg. ($2,496)	March 2002 ($1,884)	$1,500	2001 Vessel Avg. (std) n=10
Poundage	424,651	564,536	685,509	586,611 (247,661)
Individual albacore*	9,437	12,545	15,234	13,036 (5,503)
Albacore/trip**	555	738	896	767 (324)
Albacore/set+	40	53	64	55 (23)
Albacore/hook++	0.019	0.025	0.030	0.026 (0.011)

*Based on average albacore weight of 45 lbs.
**Based on 17 trips/year.
+Based on 14 sets/trip.
++Based on 2,141 hooks/set.

the nearshore area closure would restrict the amount of available fishing area to the point of unavoidable gear conflicts among big boats. Another 10% felt a nearshore area closure was acceptable around the main island of Tutuila but did not feel the need to close the areas around Swain's Island and Rose Atoll. Forty percent had no opinion of this potential management device primarily because they do not fish within 50 nm of land. Ten percent felt it was too late already but they did not explain the reasoning behind this opinion. The remaining 30% indicated they would like to see a nearshore area closure, but it is important to note that these fishers said they have not fished within 50 nm of shore in the past, nor do they plan to do so in the future.

Limited entry: The WPRFMC is now considering implementation of a limited entry program for the American Samoa longline fleet. Numerous methods of permit allocation have been suggested (DMWR, 2001). Fishers were asked, "Do you feel that the number of longline vessels (big boats) in American Samoa needs to be limited? Why? What do you feel is the optimal number of vessels?" Twenty percent of the fishers had no opinion on limited entry. Ten percent felt the fishery would "take care of itself," meaning the profitable vessels would stay and those that were not would leave. The remaining 70% thought limited entry is a necessity for the fleet. Out of those 7 vessels, one felt that too many vessels offloading at the canneries would result in lower prices, 3 were concerned about potential overfishing, and 3 felt there would be gear conflicts with other big boats. There was no mention of potential gear conflicts with alias. According to the fishers who support implementation of a limited entry program, the average number of optimal vessels would be 37 (sd = 8).

Summary

The big-boat segment of the American Samoa longline fleet operated at an estimated annual cost of $479,857 per vessel in 2001. The estimated break-even point at the 2001 albacore price was 424,651 lbs, or approximately 9,437 albacore. Logbook information from 10 vessels indicates that these vessels are landing albacore at a higher rate (586,611 lbs or 13,036 fish) than necessary to meet expenses. Future revenue will be affected by cannery prices and the potential change in catch rates as this fishery matures. Future costs may also change if parts and services become more readily available, and the service and supply industry, on which the fishery depends, also matures.

Fishers indicated a need for some management to prevent overcapitalization of the fleet. The nearshore area closure has already gone into effect and fisheries managers are also considering limited entry, a device most of the interviewees supported. Development of an efficient system to export sashimi-grade tuna to foreign markets could significantly increase the profitability of the longline fleet.

Acknowledgments

The authors offer their thanks to the vessel owners, managers, fishers and industry members for participating in the study. We also thank William A. Walsh (JIMAR/UH-Manoa); Ray Tulafono and Fini Aitaoto (American Samoa Department of Marine and Wildlife Resources); Gordon Yamasaki, Taua Tuumalo and the rest of the National Marine Fisheries Service personnel in American Samoa; Paul Dalzell (WPRFMC); David Hamm and Craig Graham (NMFS, WPacFIN); Chris King (American Samoa Department of Port Administration); and Paul Bartram.

Special thanks to John Sibert and the University of Hawai'i Joint Institute for Marine and Atmospheric Research, Pelagic Fisheries Research Program, for providing travel funds.

References

Department of Marine and Wildlife Resources. 2001. Minutes of the American Samoan longline fishery. 2nd open workshop (limited entry workshop), 11-14 September 2001. Pago Pago, American Samoa.

WPRFMC. 2000. Prohibition of fishing for pelagic management unit species within closed areas around the islands of American Samoa by vessels more than 50 feet in length. Framework Measure under the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Western Pacific Regional Fisheries Management Council, 1164 Bishop Street, Suite 1400, Honolulu, HI 96813.

PFRP

Joseph O'Malley (joseph.omalley@noaa.gov) is a Research Specialist at the University of Hawai'i Joint Institute for Marine and Atmospheric Research. Samuel Pooley is a Supervisory Industry Economist in the National Marine Fisheries Service Honolulu Laboratory.

Prep Con II—Progress on MHLC Financing and Scientific Structure

John Sibert

The second Preparatory Conference for continued planning of the MHLC's Western and Central Pacific Fisheries Commission (WCPFC) was held in Papua New Guinea late in February 2002. It was preceded by a two-day "Informal Consultation" intended to help resolve issues that are particularly vexing to certain participants, and to devise a framework within which to promote participation by interested parties.

As expected, the Consultation and week-long Prep Con that followed were attended by most of the previous MHLC participants, again absent Japan. The other notable absence was French Polynesia, which did not participate because of concerns about overlap with the Inter-American Tropical Tuna Commission (IATTC).

Promoting Participation

The Consultation opened with statements from many delegations supporting the text of the Honolulu agreement, and making it clear that reopening the text is not negotiable. Representatives of Korea reiterated many of their concerns expressed in communications to the Prep Con Chair. Representatives of the European Union, OLDEPESCA (on behalf of some of its members), and the Russian Federation expressed their support for the convention and their desire to participate in both the Commission and the Prep Cons leading to it.

Discussion was focused on three specific areas: participation of legitimate fishing players; monitoring, control and surveillance (MCS); and, "duplicity," or duplication and overlap with the IATTC, the Commission for Conservation of Southern Bluefin Tuna (CCSBT), and the Indian Ocean Tuna Commission (IOTC).
These issues reflected concerns expressed by Korea, and were handled by small discussion groups with a special interest in the issues.

With respect to duplicity, it was agreed that formal arrangements with the IATTC and CCSBT could be handled by consultations amongst commissions, and by exchange of letters. The interim secretariat, working groups and representatives of the respective organizations will prepare these letters.

There was little resolution of the issues surrounding vessel monitoring systems, observers, and boarding, but the Chair's report reflects support for establishment of an MCS working group to begin to resolve these issues.

Finally, a procedure and set of criteria were established that could be used to evaluate requests for participation and judge whether a potential member is indeed a legitimate fishing player. This would appear to have paved the way for full European Community participation.

Complete details of the informal consultation can be found in "Report of the Chairman on the outcome of the informal consultations on agenda item XI: Mechanisms to promote participation," WCPFC/PrepCon/10, 25 February 2002.

Prep Con Membership Grows

Most of work of Prep Con II was conducted in informal sessions of the working groups established at Prep Con I, but critical decisions were taken in plenary session. Although it is not clearly reflected in meeting reports, the European Community was accorded standing as a full participant in the Prep Con. The Conference also responded to a request from the Russian Federation by allowing them "to addend to observe" the Prep Con (a status distinct from "observer").

Working Group I Elaborates Finance/Administration

Working Group I (WG.I) appears to have reached consensus on the general structure of the Commission, but there is considerable scope for more definition of this structure. The Commission will have an independent and adequately resourced secretariat, but some services may be out-sourced at market rates. More details of Commission structure will become clear as other working groups conduct their work and required services are more clearly articulated (e.g. scientific and MCS services). WG.I appeared to view science as a core function, and drafted an ambitious program of work to be undertaken at Prep Cons III and IV. Costs will be taken up fully in Prep Con III, and funding formulas will be established at Prep Con IV. The full report of WG.I is available as WCPFC/PrepCon/14, 25 February 2002.

Working Group II Envisions Science Protocol

WG.II had two primary tasks. Its first was to review the Convention to identify science needs, data requirements and coordination of research, and its second was to establish provisional mechanisms via which the Prep Con can receive scientific advice.

The Commission's Interim Secretariat greatly assisted the work of WG.II by letting a contract to MRAG Americas (a British consulting firm with offices in Florida) to review options for provision of scientific services to the Commission. The MRAG report extended the work of Ward et al. and very clearly described possible levels of scientific services that the Commission could implement.

The report also clearly emphasized that data collection and analysis, and stock assessment and related modeling, are absolutely essential core scientific activities of the Commission. The report identified possible levels of expertise in these two areas, ranging from a secretariat with virtually no internal expertise, for which all data collection and stock assessment are conducted by member countries (like the ICCAT), to a "self-sufficient" secretariat that collects all its own data and conducts its own stock assessments (like the IATTC). The MRAG report recommended a "preferred alternative" near the high end of expertise.

WG.II discussed these options extensively and appeared to favor a significant scientific capability within the secretariat, but was unable to reach consensus on either the appropriate level of expertise or on reporting relationships between the secretariat, the Scientific Committee (mandated by the Convention) and the Commission. Some of the concerns about the level of scientific expertise appeared to be motivated by cost considerations, by the

Prep Con II (continued from page 9)

role of existing regional organizations like the Secretariat of the Pacific Community (SPC), and by economic doctrine.

WG.II received presentations from the IATTC and the SPC's Ocean Fisheries Programme on the costs of scientific services. Both organizations indicated that the costs of providing data collection and stock assessment would be about US$2.5 million per year for the Commission.

The interim secretariat requested information on the status of stocks from the SPC/OFP, the IATTC, the SCTB, the Interim Scientific Committee of the MHLC and other national and regional bodies. The response was a substantial pile of documents that the interim secretariat was not qualified to interpret. WG.II recommended creation of a "Scientific Coordinating Group" to assist WG.II in carrying out those parts of its terms of reference that require special scientific and technical expertise. Meetings of the SCG are to occur in conjunction with the SCTB, and the first meeting is scheduled for July 29 and 30 in Honolulu (immediately following SCTB 15; see Upcoming Events on page 5).

Headquarters, Prep Con III and Reports

The Forum Fisheries Committee nominated the Federated States of Micronesia as its choice for location of the Commission Headquarters, and the Prep Con agreed on a set of criteria to guide selection of the headquarters site. Formal bids for the site must be lodged with the Chair of the Prep Con no later than September 1, 2002.

The third session of the Prep Con will be convened in Manila, Philippines, with provisional dates of November 18–22, 2002. Most of the working papers and reports from Prep Con II can be obtained from the web site maintained by the WCPFC interim secretariat (http://www.ocean-affairs.com/DocListing.html).

Conclusions

Most participants appeared to feel that Prep Con II made significant progress on most major issues. A substantial number of issues remain to be decided, but the path to these decisions is fairly clear. The final shape of the Western and Central Pacific Fisheries Commission will be established at Prep Con III later this year. Current participants left Madang fully committed to the WCPFC and the current text of the treaty. The absence of Japanese representation at the Conference was lamented, but the process is well under way and the WCPFC will be established with or without Japanese participation

PFRP

John Sibert is Manager of the Pelagic Fisheries Research Program at the University of Hawai'i School of Ocean & Earth Science and Technology.

PFRP Pelagic Fisheries Research Program

Pelagic Fisheries Research Program
Joint Institute for Marine and Atmospheric Research
University of Hawai'i at Mānoa
1000 Pope Road, MSB 313
Honolulu, HI 96822